



Nutrition for Chronic Kidney Disease in Children

What is chronic kidney disease (CKD)?

Chronic kidney disease is any disease that causes the kidneys to function less efficiently over a long period of time. In the early stages of CKD, the kidneys continue to work. They just don't do their job as well as healthy kidneys. Because the decline in kidney function happens slowly, a child's body may adapt, without causing any change in the way the child looks or feels. Over time, small changes, such as small increases in blood phosphorus, can build up to unhealthy levels. As the kidney disease worsens, the child may develop more severe symptoms of CKD, such as weak bones, lack of appetite, lack of energy, and slowed growth.

Why is nutrition important for children with CKD?

Health problems from CKD can be prevented or delayed by eating the right foods. Every child needs good nutrition, but learning about nutrition is vital for the parents or guardians of a child with kidney disease because the child's diet can affect kidney function. In turn, the kidneys can affect the child's health and growth.

The kidneys do many things to keep the body working properly. The kidneys remove wastes and extra water from the blood and make urine. They balance the salts—sodium, potassium, calcium, and phosphorus—that circulate in the blood.

And they control the release of natural chemicals called hormones that help make red blood cells, control blood pressure, and keep bones strong.

When the kidneys don't work normally, a child's growth may slow down. The child's health care team will work with the child's caretakers to make sure the child gets the right amount of nutrients to maintain growth. At different times, the team may suggest changes in both the amount and the types of food the child needs to eat. Learning about nutrients in foods will help caretakers understand what changes need to be made to their child's diet. Caretakers should always consult with their child's health care team before making any major changes in the child's diet.

Why is energy important for children with CKD?

Everyone needs energy from food to grow and be active. Children with CKD tend to avoid eating because they have poor appetites. Taking in too little energy can lead to decreased activity, poor growth, and decreased resistance to infection. Growth is evaluated by comparing a child's height and weight with a growth chart that shows the normal ranges for children according to age. A child's energy needs change depending on age, height, and weight. The amount of energy in the diet is measured by counting calories in the food a person eats. The health care team can determine the child's daily caloric needs. If a child

is not growing as well as possible, the health care team can suggest healthy ways to add calories to the child’s diet. While feeding tubes are most often used for infants, situations occur when older children and adolescents also benefit from them.

Why is knowing about protein important for children with CKD?

Protein is an essential part of any diet. Protein helps build and maintain muscle, bone, skin, organs, and blood. Some proteins help fight disease and heal wounds. All proteins break down into waste products that must be removed from the blood by the kidneys. Eating more protein than the body needs may put an extra burden on the kidneys and cause kidney function to decline faster. The table below shows the protein content of some common foods, by serving size, listed from highest to lowest protein content.

| Protein Content of Foods | |
|--|--------------------------------|
| Food | Serving Size |
| Turkey breast | 41 grams/cup |
| Large hamburger with vegetables and condiments | 34 grams/8-ounce (oz) sandwich |
| Tuna sub | 30 grams/6-inch sub |
| Cottage cheese | 25 grams/cup |
| Chili con carne | 24 grams/cup |
| Cold-cut sub | 21 grams/6-inch sub |
| Fast-food taco | 20 grams/6-oz taco |
| Fish sandwich with tartar sauce and cheese | 20 grams/6.5-oz sandwich |
| Baked beans | 17 grams/cup |
| Chicken nuggets | 16 grams/6 nuggets |
| Yogurt | 13 grams/8-oz container |
| Beef stew | 11 grams/cup |
| Fast-food burrito with meat and beans | 11 grams/4-oz burrito |
| Cooked peas | 8 grams/cup |
| Chicken noodle soup | 6 grams/cup |

Source: United States Department of Agriculture (USDA) National Nutrient Database for Standard Reference, Release 25. USDA website. www.ars.usda.gov/SP2UserFiles/Place/12354500/Data/SR25/nutrlst/sr25a203.pdf. Released 2012. Accessed November 6, 2012.

Doctors sometimes recommend that people with CKD eat moderate or reduced amounts of protein. In children with CKD, however, restricting protein can prevent adequate growth and may lead to malnutrition. For children with CKD, the goal is to eat enough protein for growth but avoid high protein intake.

Caretakers should talk with the health care team about the amount of protein and the sources of protein in their child’s diet. Animal sources such as eggs, milk, cheese, chicken, fish, and red meats contain more of the essential amino acids the body needs, but a well-balanced vegetarian diet can also provide these nutrients. The health care team can suggest dietary changes to help meet the child’s protein needs.

The following table provides the daily protein needs by age and weight for children with CKD.

| Daily Protein Needs for Children with CKD | | | | | |
|---|-------------|--|-----------------------|---------------------|--|
| Age Range | | Grams of Protein Needed per Pound of Body Weight | | | |
| | | Pre-dialysis | Hemo-dialysis | Peritoneal Dialysis | |
| Infant | 0–6 months | 1 | 1.2 | 1.3–1.4 | |
| | 7–12 months | 0.73 | 1.1 | 1.0–1.1 | |
| Toddler | 1–3 years | 0.5 | 0.7 | 0.9 | |
| Child | 4–6 years | 0.5 | 0.7 | 0.9 | |
| | 7–10 years | 0.45 | 0.6 | 0.8 | |
| Adolescents | 11–14 years | 0.45 | 0.6 | 0.8 | |
| | 15–18 years | 0.4 | Girls 0.5 Boys 0.6 | 0.6–0.7 | |

Because dialysis removes protein from the blood, a child on dialysis needs to eat more protein. The amount of protein needed depends on the type of dialysis. In hemodialysis, the blood is filtered by flowing through tubes to a filter outside the body and then back through another set of tubes to the body. In peritoneal dialysis, the blood is filtered when a fluid called dialysis solution is drained from a bag into the child's abdomen, where it soaks up wastes and extra water from the blood and is then drained from the abdomen. Peritoneal dialysis removes more protein than hemodialysis.

For example, according to the chart, a 10-year-old boy with pre-dialysis CKD would need 0.45 grams of protein a day for each pound of his body weight. To find his daily protein requirement, his weight in pounds should be multiplied by 0.45. If the boy weighs 60 pounds, he would need 27 grams of protein a day.

[child's weight in pounds] \times [value from age chart] =
[daily protein requirement]

$$60 \times 0.45 = 27$$

Limiting a child to this amount of protein may be difficult because some foods contain that much protein in a single serving. Sandwiches should be cut in half. Smaller portions of soups and vegetables, which also contain protein, should be served.

If this same boy starts hemodialysis, he will need 0.6 grams of protein for each pound of his body weight. His daily protein needs would go up to 36 grams.

$$60 \times 0.6 = 36$$

On peritoneal dialysis, the boy's daily requirement goes up to 0.8 grams per pound. Therefore, he would need 48 grams of protein a day.

$$60 \times 0.8 = 48$$

A child's protein needs vary over time, so caretakers should discuss these needs with the health care team.

Why is knowing about sodium important for children with CKD?

Sodium, a mineral, is important for many body functions. In some children with CKD, too little sodium can lead to dehydration and poor weight gain. On the other hand, too much sodium can increase thirst, raise blood pressure, and cause water retention that may lead to excess weight gain or fluid buildup in the lungs.

Sodium is found in ordinary table salt and many seasonings such as soy sauce and teriyaki sauce. The recommended daily intake of sodium for adults is no more than 2,300 milligrams (mg), the amount found in 1 teaspoon of table salt. Canned foods, some frozen foods, and most processed foods have large amounts of table salt. Some snack foods such as chips and crackers are also high in salt. Figuring out how much sodium a child needs is complicated by the type and severity of CKD the child has, the child's age, and sometimes other factors. Caretakers may need either to limit or to add sodium to the child's diet. Caretakers should talk with their child's health care team about how much sodium their child should have.

The sodium content of foods is listed on the nutrition labels. Choosing "sodium-free" or "low-sodium" food products can help reduce sodium in a child's diet. Nearly all fresh vegetables and fresh, unprocessed meat are preferable to processed foods. Sodium-free or low-sodium seasonings such as lemon juice or hot pepper sauce can also help reduce sodium intake while adding flavor. Salt substitutes that use potassium should be avoided.

The table below explains what sodium claims on food labels such as “sodium-free” or “low-sodium” mean, as defined in federal guidelines.

| Sodium Claims on Food Labels | |
|---|---|
| Claim | Explanation |
| “Sodium-free” | Less than 5 mg sodium per serving |
| “Salt-free” | Meets requirements for sodium-free |
| “Low-sodium” | 140 mg sodium or less per serving |
| “Very low sodium” | 35 mg sodium or less per serving |
| “Reduced sodium” | At least 25 percent less sodium when compared with the regular version |
| “Light in sodium” | 50 percent less sodium per serving; restricted to foods with more than 40 calories per serving |
| “Unsalted, no added salt: not a sodium-free food” | No salt is added during processing; the labeled product resembles or substitutes for another product that is normally processed with salt |

Source: United States Food and Drug Administration (FDA) Food Labeling Guide. IX. Appendix A: Definitions of Nutrient Content Claims. FDA website. www.fda.gov/Food/GuidanceComplianceRegulatoryInformation/GuidanceDocuments/FoodLabelingNutrition/FoodLabelingGuide/ucm064911.htm. Revised April 2008. Accessed June 21, 2010.

Why is knowing about potassium important for children with CKD?

Potassium keeps the heart beating regularly and muscles working right. Too little or too much potassium can cause heart and muscle problems. When blood potassium levels are high, healthy kidneys remove extra potassium from the blood and move it to the urine. In children with CKD, the kidneys do a poor job of removing potassium and blood potassium levels can become dangerously high.

Potassium is a mineral found in many fruits and vegetables such as bananas, potatoes, avocados, and melons. Children with CKD should have their blood checked regularly to make sure their potassium levels are in the normal range. If the child’s potassium

begins to rise, caretakers should try some of the following ways to limit the amount of potassium in the child’s diet:

- avoiding high-potassium fruits and vegetables
- reducing the number and portion sizes of fruits and vegetables with moderate amounts of potassium
- boiling potatoes and beans in water to remove the potassium
- checking nutrition labels to avoid high-potassium foods and foods with potassium additives

The following table gives some high-potassium foods and suggestions for low-potassium alternatives that caretakers can serve to their children with CKD.

| High- and Low-potassium Foods | |
|------------------------------------|--|
| High-potassium Foods | Low-potassium Alternatives |
| Oranges and orange juice | Apples and apple juice |
| Melons | Cranberries and cranberry juice |
| Apricots | Canned fruit |
| Bananas | Strawberries, blueberries, raspberries |
| Potatoes | Pineapple |
| Tomatoes | Cabbage |
| Sweet potatoes | Boiled cauliflower |
| Cooked spinach | Mustard greens |
| Cooked broccoli | Frozen or raw broccoli |
| Beans (baked, kidney, lima, pinto) | Frozen peas |

Source: United States Department of Agriculture (USDA) National Nutrient Database for Standard Reference, Release 25. USDA website. www.ars.usda.gov/SP2UserFiles/Place/12354500/Data/SR25/nutrlist/sr25a306.pdf. Released 2012. Accessed November 6, 2012.

Why is knowing about phosphorus important for children with CKD?

Phosphorus helps regulate the amount of calcium in the bones. When blood phosphorus levels are high, healthy kidneys remove extra phosphorus from the blood and move it to the urine. In children with CKD, the kidneys do a poor job of removing extra phosphorus. When a child’s blood phosphorus levels are too high, the phosphorus pulls calcium from the bones, making the bones weaker and more likely to break. Poor bone growth leads to small stature. Too much phosphorus can also cause itchy skin and red eyes.

Phosphorus is a mineral found in many foods, particularly high-protein foods such as dairy products, meat, dried beans, peas, colas, nuts, and peanut butter. Caretakers should learn how much dietary phosphorus a child with CKD should have and read nutrition labels to help their child stay within those limits. The table below lists high-phosphorus foods and suggestions for low-phosphorus alternatives that caretakers can serve instead.

| High- and Low-phosphorus Foods | |
|---|--------------------------------------|
| High-phosphorus Foods | Low-phosphorus Alternatives |
| Dairy foods (milk, cheese, yogurt) | Liquid nondairy creamer |
| Beans (baked, kidney, lima, pinto) | Green beans |
| Nuts and peanut butter | Popcorn |
| Processed meats (hot dogs, canned meat) | Unprocessed meats from a butcher |
| Cola | Lemon-lime soda, root beer |
| Canned iced teas and lemonade | Powdered iced tea and lemonade mixes |
| Bran cereals | Rice and corn cereals |
| Egg yolks | Egg whites |
| Ice cream | Sorbet |

Source: United States Department of Agriculture (USDA) National Nutrient Database for Standard Reference, Release 25. USDA website. www.ars.usda.gov/SP2UserFiles/Place/12354500/Data/SR25/nutrlst/sr25a305.pdf. Released 2012. Accessed November 6, 2012.

As CKD progresses, a child may need to take a phosphate binder with meals, such as calcium acetate (PhosLo), sevelamer hydrochloride (Renagel), lanthanum carbonate (Fosrenol), or calcium carbonate to lower the concentration of phosphorus in the blood. These medications act like sponges to soak up, or bind, phosphorus while it is in the stomach. Because it is bound, not all of the phosphorus gets into the blood. Instead, some of it is passed out of the body in stool.

Why is regulating fluid intake important for children with CKD?

Early in kidney disease, a child’s damaged kidneys may produce either too much or too little urine. If the child produces small amounts of urine, swelling in the face, legs, arms, or abdomen or high blood pressure may develop. If the kidneys produce too much urine, the child is at risk of dehydration. Caretakers should tell the health care team if they notice a change in the amount of urine the child produces or if they notice any swelling.

If a child’s kidneys fail and the child begins dialysis, caretakers may need to limit how much their child drinks because one dialysis session removes only a limited amount of fluid. The amount people drink is often related to the amount of sodium they eat. If thirst is a problem, caretakers should speak with their child’s health care team about ways to control excess thirst.

What are some special problems for infants with CKD?

Because infants grow so quickly, the health care team will need to follow a child with CKD more closely during the first year of life. Often special formulas with extra supplements—calorie enhancers—will be given to ensure the child gets the right amount of fluid and nutrients. If an infant can’t drink the amount of formula needed for growth, the doctor may suggest tube feeding. While tube feeding may sound drastic, experience has shown it is often the best way to ensure a child gets the full supply of fluid and nutrients needed to promote growth and development.

How can understanding and keeping track of lab reports help a child with CKD make healthy food choices?

If a child has CKD, the child's health care team will order regular blood tests. Many caretakers find that keeping track of test results helps them see how well their child is doing. Caretakers can request copies of their child's lab reports and ask to have them explained, noting any results out of the normal range. Learning how to read a child's reports helps caretakers see how the foods their child eats can affect health results. Caretakers should talk with their child's health care team about making healthier food choices.

Points to Remember

- Chronic kidney disease (CKD) is any disease that causes the kidneys to function less efficiently over a long period of time.
- In children, CKD can cause problems such as weak bones, lack of appetite, lack of energy, and slowed growth.
- Health problems from CKD can be prevented or delayed by eating the right foods.
- Children with CKD tend to avoid eating because they have poor appetites. Taking in too little energy can lead to decreased activity, poor growth, and decreased resistance to infection.
- Caretakers should talk with the health care team about the amount of protein and the sources of protein in their child's diet. Protein helps build and maintain muscle, bone, skin, organs, and blood. But proteins break down into waste products that must be removed from the blood by the kidneys.
- Doctors sometimes recommend that people with CKD eat moderate or reduced amounts of protein to relieve the burden on the kidneys.
- In some children with CKD, too little sodium can lead to dehydration and poor weight gain. Too much sodium can increase thirst, raise blood pressure, and cause water retention that may lead to excess weight gain or fluid buildup in the lungs.
- People with CKD should avoid salt substitutes that use potassium.
- Potassium keeps the heart beating regularly and muscles working right. Too little or too much potassium can cause heart and muscle problems.
- When blood phosphorus levels are high, healthy kidneys remove the extra phosphorus from the blood and move it to the urine. In children with CKD, the kidneys do a poor job of removing phosphorus and blood phosphorus levels can become too high.
- If a child's kidneys fail and the child begins dialysis, caretakers may need to limit how much their child drinks because one dialysis session removes only a limited amount of fluid.
- Many caretakers find that keeping track of test results helps them see how well their child is doing.

Hope through Research

The National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) conducts and supports research to help people of all ages with kidney disease. The NIDDK's Division of Kidney, Urologic, and Hematologic Diseases (KUH) maintains the Pediatric Nephrology Program, which supports research into the causes, treatment, and prevention of kidney disease in children. In 2003, the KUH began the Chronic Kidney Disease in Children (CKiD) clinical trial to learn more about the negative effects of pediatric kidney disease, including cardiovascular disease and growth failure. That study is ongoing. More information about the CKiD, funded under the National Institutes of Health clinical trial number NCT00327860, can be found at www.statepi.jhsph.edu/ckid.

Participants in clinical trials can play a more active role in their own health care, gain access to new research treatments before they are widely available, and help others by contributing to medical research. For information about current studies, visit www.ClinicalTrials.gov.

Additional Reading

The following fact sheets and brochures, as well as other information, are available on request from the organizations listed below. Most of these resources can also be found online at the web addresses given.

Dining Out With Confidence: A Guide for Patients With Kidney Disease

Nutrition for Children With Chronic Kidney Disease National Kidney Foundation

30 East 33rd Street
New York, NY 10016
Phone: 1-800-622-9010 or 212-889-2210
Fax: 212-689-9261
Internet: www.kidney.org

A Healthy Food Guide for People with Chronic Kidney Disease

Academy of Nutrition and Dietetics
120 South Riverside Plaza, Suite 2000
Chicago, IL 60606-6995
Fax: 312-899-0008
Internet: www.eatright.org

Your Kidney Test Results

Solving the Diet Dilemma for Children

American Association of Kidney Patients
2701 North Rocky Point Drive, Suite 150
Tampa, FL 33607
Phone: 1-800-749-2257 or 813-636-8100
Fax: 813-636-8122
Email: info@aakp.org
Internet: www.aakp.org

For More Information

American Kidney Fund

11921 Rockville Pike, Suite 300
Rockville, MD 20852
Phone: 1-866-300-2900
Fax: 301-881-0898
Email: helpline@kidneyfund.org or
patientservice@kidneyfund.org
Internet: www.kidneyfund.org

American Society of Pediatric Nephrology

3400 Research Forest Drive, Suite B7
The Woodlands, TX 77381
Phone: 281-419-0052
Fax: 281-419-0082
Email: info@aspneph.com
Internet: www.aspneph.com

Food and Nutrition Information Center

National Agricultural Library
10301 Baltimore Avenue, Room 105
Beltsville, MD 20705-2351
Phone: 301-504-5414
Fax: 301-504-6409
Email: fnic@ars.usda.gov
Internet: www.nal.usda.gov/fnic

Medical Education Institute, Inc.

414 D'Onofrio Drive, Suite 200
Madison, WI 53719
Phone: 608-833-8033
Fax: 608-833-8366
Email: schatell@meiresearch.org
Internet: www.kidneyschool.org

About the Nutrition for Chronic Kidney Disease Series

The NIDDK Nutrition for Chronic Kidney Disease Series includes three fact sheets:

- *Nutrition for Early Chronic Kidney Disease in Adults*
- *Nutrition for Advanced Chronic Kidney Disease in Adults*
- *Nutrition for Chronic Kidney Disease in Children*

For free, single, printed copies of this series, please contact the National Kidney and Urologic Diseases Information Clearinghouse (NKUDIC).

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National Kidney Disease Education Program

3 Kidney Information Way
Bethesda, MD 20892
Phone: 1-866-4-KIDNEY
(1-866-454-3639)
TTY: 1-866-569-1162
Fax: 301-402-8182
Email: nkdep@info.niddk.nih.gov
Internet: www.nkdep.nih.gov

The National Kidney Disease Education Program (NKDEP) is an initiative of the National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, U.S. Department of Health and Human Services. The NKDEP aims to raise awareness of the seriousness of kidney disease, the importance of testing those at high risk, and the availability of treatment to prevent or slow kidney disease.

You may also find additional information about this topic by visiting MedlinePlus at www.medlineplus.gov.

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National Kidney and Urologic Diseases Information Clearinghouse

3 Information Way
Bethesda, MD 20892-3580
Phone: 1-800-891-5390
TTY: 1-866-569-1162
Fax: 703-738-4929
Email: nkudic@info.niddk.nih.gov
Internet: www.kidney.niddk.nih.gov

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